MIMULUS WIENSII (SCROPHULARIACEAE), A NEW SPECIES FROM WESTERN MEXICO

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On sunny, wet slopes in the pine forests of the Sierra Madre Occidental grow several populations of a wiry-stemmed, small, yellow-flowered *Mimulus*. They appear to be distinctly different (fig. 1) from any of the species of *Simiolus,* the section to which they apparently belong (Grant, 1924; Pennell, 1951). Therefore, on the basis of the reasons developed below, I propose recognizing them as a new species, named for Delbert Wiens, who was one of the first botanists to find them.

Mimulus wiensii Vickery, sp. nov. Ex affinitate *M. dentilobus* Rob. & Fern. et specierum affinium in toto distinguendus a caulibus filo metallico similibus, 5–24 cm in longitudine, folis subter persaepe purpureorubribus, corollarum marginibus integris.

Annual herbs with loosely spreading branches; roots fibrous, slender; stems wiry, 5–24 cm long, slender, terete, glabrous to subglabrous, green to purplish-red, prostrate to ascending, rooting at the nodes; petioles glabrous to slightly hirsute, shorter than the leaves; leaves opposite, ovate to broadly ovate, 2–20 mm long, 3–13 mm wide, dentate, palmately 3–5 nerved, green above, green to purplish-red below, glabrous to occasionally sparsely white hairy towards the base; flowers axillary, pedicels glabrous, slender, longer than the blades; calyx obturbinate, 7–11 mm long, glabrous to sparsely hairy on the margins, green, more or less red-dotted, teeth triangular, upper one the longest, the two lower curving in; corolla 10–14 mm long, weakly bilabiate, yellow, tube red-dotted, lobes entire, style glabrous, less than one third as long as the calyx; stamens shorter than the tube; capsules oblong to ovate, half as long as the calyx, not beaked; seeds small, 0.5 mm long, yellow-brown, ovate to ellipsoidal, furrowed.

Habitat: On wet, sunny slopes, in pine forests of the mountains.

Distribution: Sierra Madre Occidental and Sierra de las Palmas, Mexico.

Holotype: West of El Salto, Durango, Mexico. Growing on wet banks near kilometer 1155 on the Durango-Mazatlan road. Elevation 2615 m. August 24, 1959, *Wiens 2643,* UT 76996.

Methods and Materials

Three methods were used to investigate the relationships of *M. wiensii.* First, an experimental hybridization program was carried out. Plants of

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Fig. 1. *Mimulus wiensii* Vickery. Drawing by Julian Maack.

greenhouse cultures of two populations of *M. wiensii,* one of *M. dentilobus* Rob. & Fern.—its most likely relative—and one of a local *M. glabratus* HBK. var. *glabratus*—the commonest *Mimulus* of the area—were intercrossed in all combinations (Table 1, fig. 2). Plants of each of these four cultures were intercrossed with plants of seven test populations representative of the other species of section *Simiolus* (Table 1, fig. 2). Seeds for these cultures were collected by the author or kindly supplied by A. Carter, H. S. Gentry, W. M. Hiesey, R. Holm, G. L. Stebbins, Jr., and D. Wiens. For each cross, nine flowers, on the average, were carefully hand-pollinated. The seeds produced were sown. The resulting F_1 hybrids were grown and self-pollinated by hand to ascertain their fertility. Second, the chromosome numbers of *M. wiensii,* the other key cultures, and of most of the test cultures were determined. The same cytological methods were employed as before (McArthur et al., 1972). Third, specimens of *M. wiensii* were compared morphologically with specimens of taxa to which they might belong or to which they might be closely related in the following herbaria: GH, MICH, TEX, UC, UT, BM, K, and W. Loans of specimens by K and MICH, the hospitality of the other herbaria, and support by the National Science Foundation (Grant No. 18139) are all much appreciated. Relevant herbarium specimens examined are as follows:

Table 1. Origins of the Mimulus Cultures used in Crossing Experiments.

M. wiensii Vickery *6272:* 100 m west of divide on Durango-Mazatlan Rd., Durango, Mexico, elev. 2,500 m, *Vickery 2615* (10–15 cm form). *6273:* 100 m west of divide on Durango-Mazatlan Rd., Durango, Mexico, elev. 2,500 m. *Vickery 2616* (2–10 cm form).

M. dentilobus Rob. & Fern. *5324:* Sierra Charro, Chihuahua, Mexico, *Gentry 8073.*

M. glabratus HBK. var. *glabratus 6209:* El Salto, km 1050 on Durango-Mazatlan Rd., Durango, Mexico, elev. 2,400 m, *Wiens 2635.*

M. glabratus var. *utahensis* Pennell *5048:* Mono Lake, Mono County, California, elev. 1,935 m, *Stebbins 714.*

M. glabratus var. *fremontii* (Benth.) Grant *5063:* Black Meadow, Whipple Mountains, San Bernardino County, California, April 21, 1940, UC 667,449 (collector unknown).

M. guttatus Fischer ex DC. (obligate annual forms) *5006:* Yosemite Junction, Tuolumne County, California, elev. 390 m, *Hiesey 560. 6181:* Mt. Timpanogos, Wasatch County, Utah, elev. 2,500 m, *Vickery 2370.*

M. guttatus Fischer ex DC. (facultative perennial forms) *5052:* Mt. Diablo, Contra Costa County, California, elev. 300 m, *Stebbins 703. 5346:* Mt. Oso, Stanislaus County, California, elev. 300 m, *Vickery 190.*

M. nasutus Greene (5754–3) *5865:* Skagg's Springs, Sonomo County, California, elev. ca. 30 m, *Richard Holm, spring 1951.*

Mimulus wiensii Vickery. Holotype: *Wiens 2634;* near kilometer 1155 west of El Salto, Durango, Mexico; UT. Topotypes: *Vickery 2615, 2616;* UT. *McVaugh 22835;* near El Barroloso, Michoacan; MICH, US. *McVaugh 12896;* Nevado de Colima, above Canoa de Leoncito, Jalisco; US. *Ownbey & Ownbey 1982;* 34.9 km northeast of El Paraiso, Sinaloa; MICH, US. *Vickery 2673;* near El Palmito, Sinaloa; UT. *Vickery 2675;* near kilometer 1152, route 40, Durango; UT. *Wiens 3521;* 19 miles northwest of Santiago Papasquiaro, Durango; UT. (See also: *Gentry and Fox 11,792* under *M. dentilobus.*)

Mimulus pennellii Gentry. Holotype: *Gentry 5691;* Africa, Sierra Tacuichamona, Sinaloa; MICH.

Mimulus dentilobus Robinson & Fernald. Holotype: *Hartman 288;* Nacori, Sonora; US *Carter 2077;* Arroyo Hondo, Cerro de la Giganta, Baja California del Sur; US, GH. *Gentry 572 M;* La Mesa Colorado, Sonora-Chihuahua; MICH. *Gentry 7220;* Penasco, Los Pucheros, Sierra Surotato, Sinaloa; MICH. *Gentry 8073;* Arroyo Hondo, Sierra Charuco, Chihuahua; MICH, UT. *Gentry 8085;* Rancho Byerly, Sierra Charuco, Chihuahua; MICH, US. *Gentry and Fox 11,792;* La Champagna, Sierra de las Palmas, south of Santa Rosalia, Baja California; MICH (sheet includes one specimen of *M. wiensii*). *Maguire, May 23, 1935;* Bear Canyon, 10 km east of Gila, Grand Co., New Mexico; UC, GH, US. *McVaugh 7472;* Horse Creek, Chinati Mountains, Presidio Co., Texas; MICH. *Pennell 19,517;* Arroyo Gochico, east of San Bernardo, Sonora; MICH, US.

Mimulus madrensis Seeman. Holotype: *Seeman 2110,* 1852–57; in swamps on the road from Durango to Tepic, Mexico; K, BM.

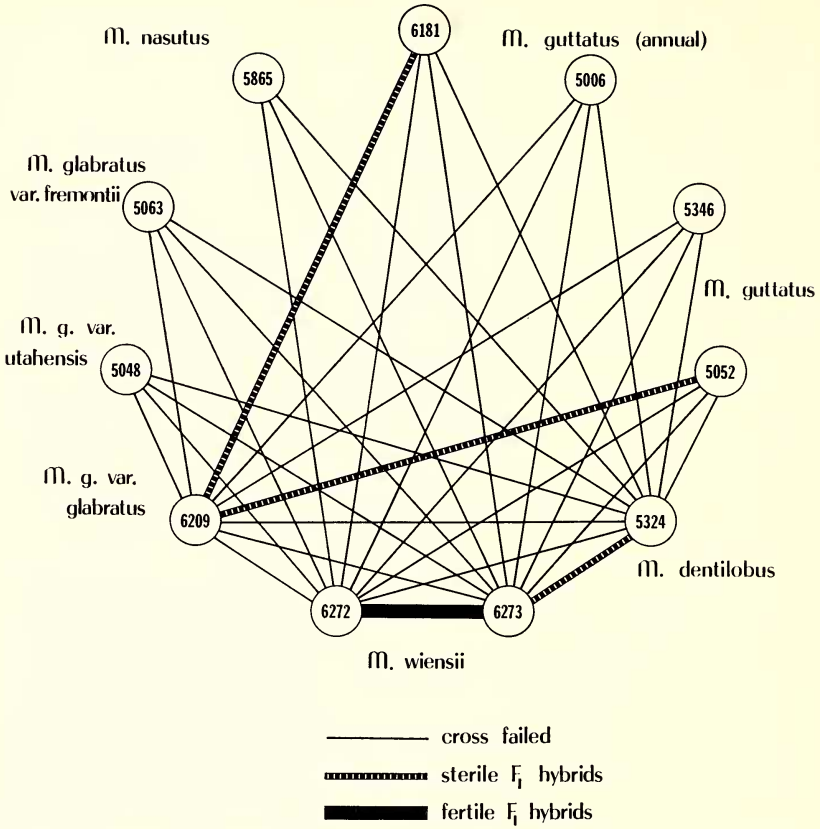

FIG. 2. Crossing relationships of cultures of *M. wiensii* Vickery and *M. dentilobus* Rob. & Fern. of the *Mimulus dentilobus* complex with each other and with representative taxa of the rest of section *Simiolus*.

Mimulus parvulus Wooton & Stanley. Holotype: *Holzinger, Aug. 27-Sept. 12, 1911;* Rocky Canyon, Mibres Valley, near Silver City, Grant Co., New Mexico; US.

RESULTS AND DISCUSSION

Experimental hybridization produced only five different F_1 hybrids from the 64 combinations tried (fig. 2). Two of the hybrids were the result of intercrossing the cultures of the two populations of *M. wiensii*, *6273* × *6272* and the reciprocal cross, *6272* × *6273*. Hybrids from the first cross had essentially normal fertility, 18 seeds per capsule compared to the parents' 5 and 42 seeds per capsule, respectively. The F_2 hybrids of this cross were vigorous and fertile also. However, *6272* × *6273* F_1 hybrids were sterile, that is, they set no seeds when self-pollinated. Intraspecific unidirectional barriers to gene exchange such as this, are well

known in *Mimulus* (Vickery, 1964, 1966, 1969). The third successful hybridization was between *M. dentilobus* and *M. wiensii, 5324* × *6273* (fig. 2). This F_1 hybrid proved to be sterile too, but is remarkable in that it is the only combination in 76 different hybridizations attempted between *M. dentilobus* and other species of section *Simiolus* that produced a hybrid (Vickery, in press). Clearly, *M. dentilobus* is more closely related to *M. wiensii* than it is to any other species tested in section *Simiolus*. The last two successful hybridizations (fig. 2) did not involve either *M. wiensii* or *M. dentilobus,* but only the test cultures. Thus, *M. wiensii* exhibits a partial unidirectional barrier to gene exchange between its two populations tested, is completely isolated from its relative, *M. dentilobus,* by the sterility of the F_1 hybrids formed, and is separated from representative taxa of the rest of the section by a complete failure to produce viable hybrid seeds in the interpopulation crosses (fig. 2).

Cytological results are consistent with the crossing results. Both populations of *M. wiensii* and the one of *M. dentilobus* have $\mathbf{n = 16}$ (Mukherjee et al., 1957; Mia et al., 1964). This is a unique chromosome number for section *Simiolus* except for distinctly different *M. gemmiparus* Weber, a propagule-producing species of the Rocky Mountains (Vickery et al., 1968; Weber, 1972). Of the test populations, the *M. guttatus* cultures *5006* and *5052* have $\mathbf{n = 14}$ (Mukherjee et al., 1957; Mukherjee and Vickery, 1960) as probably do cultures *6181* of *M. guttatus* and *5865* of *M. nasutus* (Vickery, in press). Of the three tested varieties of *M. glabratus* the local population, *6209* of *M. glabratus* var. *glabratus* has $\mathbf{n = 31}$ (Mia et al., 1964), *5063* of *M. glabratus* var. *fremontii* has $\mathbf{n = 30}$ (Mukherjee and Vickery, 1960), and *5048* of *M. glabratus* var. *utahensis* has $\mathbf{n = 15}$ (McArthur et al., 1972). Thus, *M. wiensii* and *M. dentilobus* form a small complex of taxa with $\mathbf{n = 16}$ that is cytologically distinct from the rest of the section except for rather distantly related *M. gemmiparus*.

Detailed morpological comparisons (Table 2) reveal that *M. wiensii* exhibits some traits in common with *M. dentilobus* Robinson & Fernald but is clearly distinct from all the other species of section *Simiolus* as recognized by Grant (1924) and Pennell (1951). In addition, *M. wiensii* shows some similarities with three little-known species not recognized or not included in Grant's monograph or Pennell's treatment. These species are *M. madrensis* Seeman, *M. pennellii* Gentry, and *M. parvulus* Wooton & Stanley. *Mimulus madrensis* Seeman is known only from the type collection, lacks the erose corolla margins that are the hallmark of *M. dentilobus,* and has blunt-tipped leaves in contrast to the pointed, acute leaf tips of *M. wiensii* (Table 2, fig. 1). *Mimulus pennellii* Gentry also is known only from the type collection and has variable, entire to apiculate or slightly erose corolla lobes in contrast to the deeply erose ones of *M. dentilobus* and the entire ones of *M. madrensis* and *M. wiensii* (Table 2, fig. 1). The name *Mimulus parvulus* Wooton & Stanley seems to be a

Table 2. Characteristics of the Four Species of the Mimulus dentilobus Complex.

	M. dentilobus	*M. madrensis*	*M. pennellii*	*M. wiensii*
Chromosome number	n = 16	?	?	n = 16
Plant habit	prostrate, creeping, forming dense mats (in shade somewhat ascending)	prostrate, ends ascending plants are low, creeping forming dense mats	ascending, creeping forming mats	ascending, forming dense mats
Stem length, cm	1–8	3–14	3–10	5–24
Stem diameter, mm	0.6–1.0	0.2–0.5	0.5–1.0	1.0–1.2
Stem pubescence	glabrous	glabrous	pubescent at the nodes	glabrous, rarely sparsely pubescent
Foliage	light green, rarely darkened with anthocyanin	green	green	usually darkened with anthocyanin
Leaf blades	broadly ovate to sub-orbicular	broadly ovate to sub-orbicular	broadly ovate	ovate to broadly ovate
Leaf blade length, mm	2–10	3–8	3–12	2–20
Leaf blade width, mm	2–9	2–11	2–14	3–13
Leaf surface	not scurfy, scattered punctate glands	crystaline, almost scurfy	slightly crystalline, almost scurfy	punctate, not scurfy

Leaf apex	tending toward blunt	blunt	tending toward acute	often acute
Leaf margins	shallowly sinuate-crenate	shallowly sinuate-crenate	serrate	serrate
Petioles	mostly winged	mostly winged	mostly winged	not winged except near the blade
Leaf venation	lateral veins obscure or the venation reticulate	lateral veins distinct to obscure	lateral veins distinct to obscure	lateral veins typically distinct
Leaf pubescence	glabrous	glabrous	pubescent at the nodes	glabrous, rarely sparsely pubescent
Calyx	slightly accrescent	slightly accrescent	accrescent	accrescent, elongating to as much as 11 mm in fruit
Mature calyx length, mm	5–7	5–7	6–9	7–11
Corolla length, mm	8–14	9–12	8–11	10–14
Corolla lobe margins	toothed to deeply lobed or deeply erose	entire, not apiculate or erose	apiculate to moderately erose	entire, not apiculate or erose
Style	exceeding calyx by more than ½ its length	exceeding calyx by more than ½ its length	exceeding caylx by less than 1/3 its length	exceeding caylx by less than 1/3 its length

synonym of *M. dentilobus* and does not refer to a distinct entity. *Mimulus wiensii* does not appear to be within the known range of variation of either of the rare species, *M. madrensis* and *M. pennellii,* or of the better known *M. dentilobus.* These four taxa *(M. wiensii, M. madrensis, M. pennellii,* and *M. dentilobus)* exhibit enough morphological similarities (Table 2) to suggest that they form a distinctive species complex, the *M. dentilobus* complex. However, the differences among them are sufficiently great to suggest that each should be maintained as a separate species.

The center of distribution for the *M. dentilobus* complex appears to be Sinaloa. Available collections (see above) show *M. dentilobus* to have a broad range from Sinaloa north to New Mexico, east to Texas, and west to Baja California. *Mimulus wiensii* has a smaller range that extends from Sinaloa south to Jalisco and west to Baja California. The other two species apparently are restricted endemics of Sinaloa and the adjacent states to the south.

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